CO_2 Capture Project 2

The CO_2 Capture Project Phase 2 (CCP2) Storage Program: Progress in Geological Assurance

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CCP2-SMV Objectives

- Target technology development essential to the public assurance of geological storage of CO_2.
- Address emerging issues in CO_2 storage.
- Systematize site assessment and protocols.
- Ready potentially cost effective technologies for deployment.

CCP2-SMV Program Status

- The SMV program has gained additional support through the new CCP Associates Member program with Repsol and EPRI joining.
- The program is well rounded in addressing gaps in integrity, optimization, monitoring and risk assessment.
- The program projects are on track for 2008 completion.
- At the conclusion of CCP2, project results will be available for use by demonstration projects through collaboration with the CCP3-SMV program.

CCP2 Path Forward

- The CCP2-SMV team has developed a slate of projects to:
  - Develop key operational and monitoring strategies.
  - Address CO_2 containment issues for wells and reservoir seals.
  - Develop a simplified tool for lifecycle monitoring and decommissioning schemes.
- Protocols and developed technologies will be tested through appropriate collaborative pilot or demonstration projects.
- The CCP2-SMV Policies & Incentives team and stakeholders will continue to be engaged to ensure that technology development remains relevant through the project timeframe.

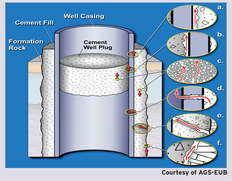
Featured Projects

Well Integrity Field Study

Well Integrity has become the premier containment issue in geological storage of CO_2.

A comprehensive well field study has been developed to evaluate well condition, predict survivability, and identify engineering solutions. The study includes accessing a CO_2-experienced well for evaluation of well condition. The program includes:

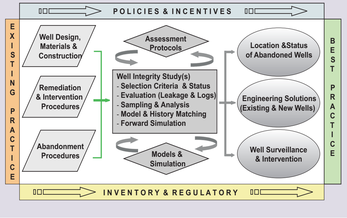
- Well selection (production/workover records, operational status)
- Characterization (logging)
- Fluids and solids sampling (casing, cement, and country rock)
- Materials alteration (petrographic and geochemical analysis)
- Chemical kinetics (exposure experiments)
- Chemical modeling (fluid proxy inference and cement condition)
- 3D model of well with reconstruction of alteration history
- Simulation of well fate over an extended amount of time
- Recommendations on well design or materials and new approaches to remediation and intervention



Courtesy of AGS-EUB

Project Status

- The first field survey data/samples have been obtained and are under evaluation.
- Modeling has been progressing independent of well data. Model program details will follow sample analysis results.

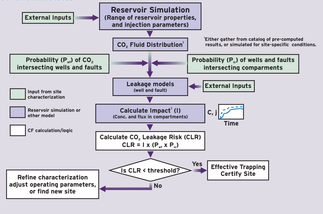


Certification Framework

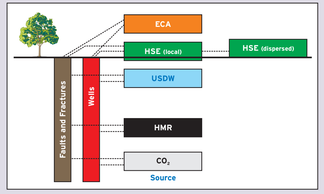
A simple, transparent, and accepted basis for regulators and stakeholders to certify that the risks of geologic CCS projects to HSE and resources are acceptable is critical to the wide scale deployment of CCS. At present, site selection criteria, reservoir simulation approaches, and risk assessment methodologies are fragmented and vary in complexity.

The "Certification Framework" project integrates site assessment, reservoir engineering, and risk assessment onto a single, simplified platform with the guidance of technical experts and regulatory stakeholders.

Certification Framework: Scheme and Status



Timeline for Geologic CO_2 Storage



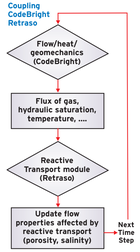
Operational Parameters

Coupled Geochemical-Geomechanical Simulation

Interaction of CO_2 in reservoirs results in pressure increases that can fracture reservoir rock or breach cap rocks.

The coupled geochemical-geomechanical simulation tests the extent to which the aperture opening effect (permeability increase) of pressure can be counteracted by geochemical reactions that act to reduce pressure increase.

The study aims to develop a tool for assessing the effect of CO_2 injection on reservoir and cap rock integrity. Existing simulation programs will be improved and integrated to more accurately predict fluid-rock response to CO_2 injection and its impact on the containment system integrity. The resulting application will be based on open source code and therefore amenable to testing and improvement by others.



Project Status

- Coupled models have been selected and code is being updated and tested.
- Testing on a real reservoir will be done as soon as essential simulation pieces are in place.
- A test site has not been determined.

Operability of ECBM

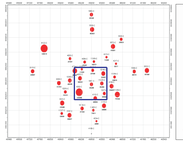
Coal bed methane (CBM) recovery might be enhanced by CO_2 via desorption of methane and adsorption of CO_2. The low permeability and reactivity of coal, however, introduce injectivity and conformance complications.

Simulation of CO_2 flooding using data from the Blue Creek field (Alabama) is applied to optimize CO_2 injection and CH_4 production rates while avoiding formation damage and cap rock breaching.

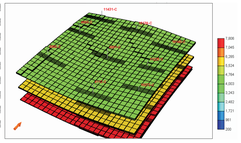
Project Status

- Geological data has been obtained and put into a 3D model.
- A simulation model has been built for producing coal seams only.
- Model calibration is in progress.

Deerlick Creek Model Area



3-D View of Model - Cleat Pressure (kPaa)



Monitoring

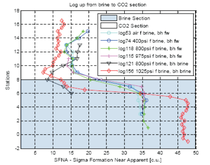
Well-Based *in situ* Detection of CO_2

A simple, reliable technique for monitoring leakage through wells will help address well integrity concerns.

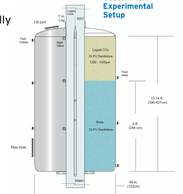
A novel well design that allows subsurface CO_2 accumulation, using conventional logging tools (e.g., RST) for detection. A pressurized vessel containing water-saturated sand was injected with supercritical and vapor phase CO_2.

Project Status

- The project is complete.
- The concept was demonstrated successfully



Custom Tank Experimental Setup



Remote (Aerial) Detection of CO_2 and Methane

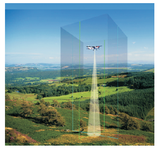
Monitoring CO_2 leakage to the surface over field-scale areas will introduce considerable operating and post-closure expenses to CO_2 storage projects.

Remote (satellite and aerial) sensing of CO_2 and methane will be a potential solution if sensors capable of directly detecting both gases are developed. This project has tested a modified sensor using aerial field surveys over controlled leaks.

Gas Absorption

For passive sensors such as MASTER, light from the sun that is reflected and re-emitted from the ground passes through the gas plume. All molecules absorb light in very discrete and narrow wavelength bands of visible, infrared, and thermal light. By focusing on these bands of absorption, we can watch and predict how much less energy reaches the sensor over a gas plume as opposed to an unaffected area.

This image was created from the full run of MASTER at an elevation of approximately 1,400 meters. Pixel size is roughly 1.5 square meters. All seven leak points in the virtual pipeline are labeled in unique colors.



Original Photo taken from: http://www.nett.doe.gov

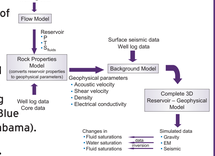
Project Status

- The MASTER instrument was tested at the Rocky Mountain Oilfield testing center on August 3, 2006.
- Preliminary results have shown that MASTER has the potential to be sensitive to temperature variations in the thermal infrared and to the absorption effect of CO_2 in the 4.3 µm region.
- Work is planned to study the effect of CO_2 in the 2.06 µm region and of CH_4 in the 2.36 µm region.

Novel Geophysical Monitoring of ECBM Performance and Leakage

Seismic monitoring might add significant expense to low margin operations such as CO_2 ECBM and may not be applicable in some settings.

The resolution of low cost novel non-seismic geophysical techniques (EM and SP) will be simulated using data from the Blue Creek field (Alabama).



Project status:

- Rock physics model has been developed
- Further work is waiting on results from flow simulations on the Deerlick Creek field

Further information, visit:
www.co2captureproject.org

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